

Appendix C.2. Terbufos Aquatic Ecological Incidents.

Crop	Year	State	Number Affected	Species Affected	Certainty Index, Use Pattern, Residue and CHE Analysis, (Reference)
corn	1998	IN	10,000 3,000 100 200	bluegill largemouth h bass catfish walleye	Possible. The fish kill occurred on June 19, 1998 in a 15 acre, 20 foot deep, farm pond in Lagro, IN. The grower applied the 20CR formulation of terbufos as a T-band application at planting at the rate of 1.3 lbs ai/A to a 75 acre corn field. The “field drains into neighbor’s farm pond and pond overflows into reported pond incident”. Analysis of water samples revealed no evidence of terbufos residues. (I007795-002)
corn	1998	IN	2,000- 3,000 500	bluegill largemouth h bass	Possible. The fish kill occurred on June 19, 1998 in a farm pond in Lagro, IN. The grower applied the 20CR formulation of terbufos as a T-band application at planting at the rate of 1.3 lbs ai/A to a 75 acre corn field. The field drains via tile into the farm pond. There is also a 2 to 3 foot deep drainage ditch that carries runoff into the pond. Analysis of water samples revealed no evidence of terbufos residues. (I007795-001)
corn?	1998	IN	2,400 20 10 1	bluegill bass frogs carp	Probable. The fish kill occurred on June 18, 1998 in a farm pond in Huntington, IN. The grower applied the 20CR formulation of terbufos as a T-band application at planting at the rate of 1.3 lbs ai/A to a 46 acre field. Analysis of water samples revealed terbufos sulfoxide and terbufos sulfone residues. (I007676-001)
corn?	1998	IN	>5,000	bluegill bass catfish minnows crappie	Probable. The fish kill occurred on June 13, 1998 in a 2 acre farm pond in LaFountaine, IN. The grower applied the 20CR formulation of terbufos as a T-band application at planting at the rate of 1.3 lbs ai/A to a 76 acre field. Analysis of water samples revealed terbufos sulfoxide and terbufos sulfone residues. (I007924-006)
corn?	1998	IN	1400	fish	Probable. The fish kill occurred on June 13, 1998 in 2 farm ponds in Lewis, IN. The grower applied the 20CR formulation of terbufos as a t-banded application at planting at the labeled rate. Analysis of water samples revealed terbufos sulfoxide and terbufos sulfone residues. (I007924-005)
corn?	1998	IN	~1100 50-75 200	bluegill bass crappie	Probable. The fish kill occurred on June 14, 1998 in a 3 acre farm pond in Wabash, IN. The grower applied the 20CR formulation of terbufos as a T-band application at planting at the rate of 1.3 lbs ai/A. Mortality estimates for bluegill ranged from 1000-1200. Analysis of water samples revealed terbufos sulfoxide and terbufos sulfone residues. (I007924-004)

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corn?	1998	IN	1000 100 50	bluegill bass walleye	Probable. The fish kill occurred on June 16, 1998 in a 2 acre farm pond in Wabash County, IN. The grower applied the 20CR formulation of terbufos as a T-band application at planting. Analysis of water samples revealed terbufos sulfoxide and terbufos sulfone residues. (I007924-003)
corn?	1998	IN	5,100 100	bluegill bass	Probable. The fish kill occurred on June 13, 1998 in 2 farm ponds in Chester, IN. The grower applied the 20CR formulation of terbufos as an in-furrow application at planting at the rate of 1.3 lbs ai/A to a 38.5 acre field. Analysis of water samples revealed terbufos sulfoxide and terbufos sulfone residues. (I007924-002)
corn?	1998	IN	60 32 1	bluegill bass catfish	Probable. The fish kill occurred on June 16, 1998 in a 0.8 acre farm pond in Wabash, IN. The grower applied the 20CR formulation of terbufos as a T-band application at planting at the rate of 1.3 lbs ai/A to a 74 acre field. Analysis of water samples revealed terbufos sulfoxide and terbufos sulfone residues. (I007924-001)
corn?	1997	corn belt	NR	fish	Possible. American Cyanamide reported 5 fish kill incidents involving farm ponds in Indiana, Nebraska, and possibly other corn belt states in 1997 (I006718-001)
corn?	1996	corn belt	NR	fish	Possible. American Cyanamide reported 1 fish kill incident in the corn belt in 1996 (I004607-001; I006718-001)
corn?	1995	corn belt	NR	fish	Possible. American Cyanamide reported 4 fish kill incidents involving farm ponds in the corn belt in 1995 (I002814-001, I006718-001)
corn?	1994	corn belt	NR	fish	Possible. American Cyanamide reported 7 fish kill incidents involving farm ponds in the corn belt in 1994 (I002814-001, I006718-001)
corn	1994	NC	100	bass bluegill crappie	Probable. On May 10, 1994, the North Carolina Department of Agriculture reported a fish kill incident involving approximately 100 fish, that occurred in a canal that fed into the Pasquotank River in Pasquotank County. Terbufos (Counter 20CR) had been applied to a corn field adjacent to the canal. Residue analysis revealed 140 ppb of terbufos in the canal. (I003826-025; IR94-51; North Carolina Department of Agriculture)
corn	1994	LA	1386	fish	Probable. Terbufos and permethrin applied preplant to 3769 acres of corn. The Louisiana State University Medical Diagnostic Laboratory concluded that the fish were killed by terbufos and permethrin. (I001849-003; I001179-20)

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corn?	1993	corn belt	NR	fish	Possible. American Cyanamide reported fish kill incidents at 14 farm ponds in the corn belt in 1993 (I002814-001, I006718-001)
corn	1993	NC	15 15	bass bream	Highly Probable. A fish kill occurred in Clinton, NC (Sampson County) on April 16 following application of atrazine and terbufos to a neighboring corn field approximately 365 feet away. Water samples taken a week later revealed 2 ppb of terbufos. No analyses were conducted on the dead fish. (I003654-003)
corn?	1992	corn belt	NR	fish	Possible. American Cyanamide reported 2 fish kill incidents in the corn belt in 1992 (I002814-001, I006718-001)
corn tobacco	1992	NC	small number	bluegill	Possible. A fish kill in a small pond adjacent to tobacco and corn fields in North Carolina on June 12, 1992. Terbufos, carbofuran, and aldicarb were applied to adjacent fields (I000165-052).
corn?	1991	IA	NR	fish	Probable/Misuse Grower in Fontanelle, Adair County, IA, reportedly left partially used bag of Counter® 15G eight feet from pond. (B000170-6; I002814-002)
corn	1991	IA	4,000-5,000	bluegill, crappie, small bass	Probable. This incident involved 6 ponds in Chariton, Lucas County, IA. Residue analysis 2 to 4 weeks after treatment showed 1-4 ppb terbufos sulfoxide in the pond. (B000170-4, I002814-002)
corn	1991	IA	large number	bluegill bass crappie catfish	Probable. Fish kill occurred on June 9 in several ponds east of Chariton, IA. The largest pond (3.5 acres) was surrounded by 300-1000 feet of pasture/grassy buffer strip. Terbufos was applied as a banded application on an adjacent farm. Terbufos residues (1 ppb) recovered from pond water on July 6. No analyses made on dead fish. (B000300-41)
corn	1991	IA	500 400 3	bluegill bass snapping turtle	Probable. Fish kill occurred in 2 ponds in Milo, Warren County, IA. Incident is related to a study by Wildlife International. Pond surrounded by grassy strips and steep sloped corn fields . Terbufos also caused a fish kill in these ponds in 1990. (B00170-005 I002814-002).
corn	1991	IA	NR	fish	Possible. Pond near corn field in Lucas County, IA experienced a fish kill in June, 1991. No residue analysis performed. (I000254-002: Submitted by Region VII)

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corn	1991	IA	NR	bluegill bass crappie catfish	Highly Probable. Pond near corn field in Lucas County, IA experienced fish kill in June, 1991. Residue analysis revealed terbufos in water following kill and 3 weeks later. Trifluralin and Bicep also applied. (I000254-001; Submitted by Region VII)
corn	1991	IL	1,000	bluegill	Probable. Pond in Nashville, Washington County, IL experienced a fish kill. An assay conducted 2 weeks after treatment revealed 3 ppb terbufos sulfoxide (I002814-002; I000170-001)
corn	1991	IL	41,800 38,000 6,318 4,343	bluegill bass sunfish crappie	Highly Probable. On May 4, 1991, terbufos was applied at a rate of 1.3 lb ai/A on a no-till corn field adjacent to Taylor Lake, in Victoria, IL (Knox County). Taylor Lake is a former strip mine. A total of 90,461 fish were found dead. The species affected included bluegill, largemouth bass, green sunfish, black crappie, red-ear sunfish, and hybrid sunfish. The dead sunfish had the pectoral fin in the forward position across the head: which is considered to be a sign of OP toxicosis. An assay conducted 2 weeks after treatment revealed 2 to 9 ppb terbufos sulfoxide (I005002-003; B000166-001; I002814-002; I000170-2; Illinois Department of Conservation, 1991)
corn	1991	IN	1,500	bluegill crappie	Possible. Incident occurred in Whiteland, Brown County, IN involving 1500 bluegill and crappie fingerlings,. No assay was conducted. (I002814-002; I000170-003)
corn tobacco	1991	NC	200+	bluegill bass	Possible On May 10, 1991, a fish kill occurred in Onslow, North Carolina Terbufos, disulfoton, ethoprop, chlorpyrifos, atrazine, and napropamide were applied to adjacent corn and tobacco fields. Analysis of pond water and surrounding soils found terbufos, chlorpyrifos, napropamide, and atrazine residues. Because the chlorpyrifos and terbufos residues were higher than napropamide, and atrazine residues, they were considered more likely to have caused the kill. The crops that were associated with the fish kill were corn and tobacco. Terbufos was applied to the corn crop only. A corrugated pipe connects the fields to a drainage ditch and a concrete pipe to connects the ditch and runs under the road to the pond. Apparently pesticide application was applied too close to water. (I000799-004; IR91-60 North Carolina Dept. of Agriculture)
corn or sorghum	1991	TX	NR	fish	Possible. Incident occurred on April 19, 1991 in a lake adjacent to a 500 acre treated field in Lamar, Texas. Assay of water samples was negative. Crop listed in report as field crop/grain with the pest as greenbug. (I00917-004; TDA incident No. 11-91-0017)
corn	1990	IA	300	bluegill	Probable. Event occurred in Audubon County, IA. Terbufos sulfoxide found in residue analysis. (B00168-002, I002814-003)

Crop	Year	State	Number Affected	Species Affected	Certainty Index, Use Pattern, Residue and CHE Analysis, (Reference)
corn	1990	IA	200	bluegill	Probable. Event occurred in Audubon County, IA. Terbufos sulfoxide found in residue analysis. (B00168-001, I002814-003)
corn	1990	IA	200+	bluegill	Probable. Event occurred in Montgomery County, IA. Field sloping towards pond. Terbufos sulfoxide found in residue analysis. (B00168-003, I002814-003)
corn	1990	IA	200+	bluegill	Probable. Event occurred in Warren County, IA. Terbufos sulfoxide found in residue analysis. (B00168-006, I002814-003)
corn	1990	IA	200+	bluegill	Probable. Event occurred in Milo, Warren County, IA. Incident is related to a study by Wildlife International. Terbufos sulfoxide found in residue analysis. (B00168-005)
corn	1990	IA	500	bluegill	Possible. Event occurred in Washington County, IA. No residue samples taken (B000168-004, I002814-003)
corn	1990	IA	200+	bluegill	Probable. Event occurred in Warren County, IA. Terbufos sulfoxide found in residue analysis. (B00168-006, I002814-003)
corn	1990	IL	150	bluegill	Possible. Event occurred in Coles County, IL. No residue samples taken (B000168-013, I002814-003)
corn	1990	IL	10,000-15,000	fish	Possible. Event occurred in McHenry County, IL. No residue samples taken (B000168-014)
corn	1990	IL	NR	bluegill	Probable. Event occurred in Du Page County, IL. Terbufos found in residue analysis. (B00168-015)
corn	1990	IL	20	bluegill	Probable. Event occurred in St Clair County, IL. Terbufos sulfoxide found in residue analysis. (B00168-0016)
corn	1990	KS	300	fish	Probable. Event occurred in Leavenworth County, KS. Terbufos was applied in furrow. Terbufos sulfoxide found in residue analysis. (B00168-007)
corn	1990	MI	500-600	bluegill	Probable. Event occurred in Hillsdale County, MI. Terbufos was applied as a banded application. Terbufos sulfoxide found in residue analysis. (B00168-008)

Crop	Year	State	Number Affected	Species Affected	Certainty Index, Use Pattern, Residue and CHE Analysis, (Reference)
corn	1990	OH	100 % in 4-5 acre pond 1	bass, bluegill, catfish, crappie, snake	Probable. On May 15, 1990, bass, bluegill, catfish, crappie, and a black snake were reported killed from the use of terbufos applied in-furrow at-planting on a corn field at a rate of 1.3 lb ai/A in Licking County, Ohio. The Ohio Department of Agriculture measured terbufos residues of 10 ppb . Ammonia, atrazine, and metalachlor residues were also found. The investigator concluded that the kill could have been caused by terbufos or ammonia. The total kill was reported for the 4 to 5-acre pond that was 5 to 6 feet deep (B000168-12; 422059-01; American Cyanamid, 1992).
corn	1990	OH	NR	bluegill	Probable. Event occurred in Clinton County, OH. Terbufos was applied as a banded application. Terbufos sulfoxide found in residue analysis. (B00168-010)
corn	1990	OH	1,500-1,800	bluegill	Possible. Event occurred in Darke County, OH. Terbufos was applied as a banded application. There was no residue analysis performed. (B00168-011)
corn	1990	OH	10,000-15,000	bluegill	Probable. Event occurred in Licking County, OH. Terbufos was applied as an in furrow application. Terbufos sulfoxide found in residue analysis. (B00168-009)
corn? sorghum?	1990	TX	200	fish	Probable. Incident occurred in Bell County, Texas. Investigators suspect that runoff from the neighbors field into tank caused the fish to die. Samples of fish analyzed contained terbufos. Crop listed in report as field crop/grain. Corn and sorghum are the most likely crops to have been involved. Metalachlor, 2,4-D, atrazine, and picloram were also applied to adjacent fields. (I00917-003; TDA incident No. 05-90-0034)
corn	1989	NC	600 12	small fish crayfish	Highly probable. On May 5, 1989, a fish kill occurred from the use of Counter 15G on a nearby corn field in Sampson County, NC. About 600 small fish and 12 crayfish were found dead in an adjacent water body. The corn field was treated on April 20. The metabolite of terbufos, terbufos sulfone, was detected in the water samples (B000169-001; IR89-40. North Carolina Department of Agriculture, 1989).
corn	1989	NC	2000+	fish	Highly probable. On April 30, 1989, thousands of fish were killed in a canal which feeds into the Alligator River following the application of terbufos 15G and alachlor to corn in Tyrell County, NC. By the time the fish kill was investigated on May 1, 1989, the fish had drifted into the Alligator River. Terbufos had been applied in-furrow at-planting and alachlor on top after planting. Terbufos sulfone, the metabolite of terbufos, was detected in soil samples (B000164-001; R89-37. North Carolina Department of Agriculture, 1989).

Crop	Year	State	Number Affected	Species Affected	Certainty Index, Use Pattern, Residue and CHE Analysis, (Reference)
corn	1989	NC	400	fish	Highly probable. On May 16, 1989, about 400 fish died from the use of Counter 15G. Terbufos was measured in the water samples taken in a pond adjacent to a field that was treated with terbufos on corn. An adjacent tobacco field had been treated with ethoprop and pebulate, but no measurable residues were detected for those chemicals (B000167-001; IR89-44. North Carolina Department of Agriculture, 1989).
corn	1985	NE	1000	fish	Possible. Terbufos was applied in a corn field in Butler County, NE on May 8, 1985. The water source for this pond was filtered overflow from a larger pond which had also suffered a fish kill at the same time. Terbufos (applied in-furrow to corn) and phorate (applied to sorghum) had recently been used in nearby fields above the pond. (I000598-001A; Nebraska Game and Parks Commission, 1985).
corn?	1985	NE	“many”	fish	Possible. In 1985, terbufos was applied in a field near a pond in Richardson County, NE. (I000598-007. Nebraska Game and Parks Commission).
corn	1984	SC	100 100	bass bream	Possible. On April 2, 1984 a fish kill was reported in Williamsburg County, SC. Terbufos, atrazine, and metalochlor were used on the adjacent corn field 2 to 3 days before the kill. Analysis of a water sample showed no terbufos residues but tested positive for atrazine and metalochlor. (B000163-001)
corn	1981	MO	not reported	fish	Possible. Fish kill occurred on May 29, 1981 in Krueger Pond, Lafayette County, MO (near the town of Alma). A one acre pond was affected. Butylate and atrazine were also applied to the corn field (B000165-001; I000636-032).
corn	1981	MO	not reported	small bluegill few crappie	Possible On June 3, 1981, terbufos was implicated in a Missouri fish kill with multiple pesticide use (atrazine, Sutan and terbufos). Many small bluegill and a few crappie reportedly were affected from the use on corn (Missouri Department of Conservation, 1981).
corn	1978	IA	many	fish	Possible Terbufos was applied in a corn field in Iowa in 1978. Runoff into a farm pond drained about ½ acre of the treated corn field. Many dead fish were found in the pond (Pesticide Incident Monitoring System, 1981.).
NR	1976	IL	20	bluegill	Possible. Around April 1976, terbufos was applied to a field across the road from a 0.8 acre pond in Illinois. About 20 dead bluegill were found. Laboratory work did not confirm the presence of terbufos (Pesticide Incident Monitoring System, 1981).

NR = Not reported
CI = certainty index

Notes: hundreds interpreted as 200+
 thousands as 2,000+
 soil incorporated interpreted as in-furrow application
 surface application interpreted as banded application